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Daniel J. Repeta

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Woods Hole Oceanographic Institution
Woods Hole, MA 02543

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13. ABSTRACT *(Maximum 200 words)*

Long term Research Objective: Colored dissolved organic matter (CDOM) is one of the principal light-attenuating components of seawater. Over the past decade considerable progress has been made in describing the optical properties of CDOM. However, our understanding of CDOM structure and chemistry has not advanced apace, and we do not yet understand many of the factors that introduce and remove CDOM in seawater. Our objectives are to chemically characterize CDOM and to develop techniques for studying CDOM cycling in seawater. Recent work suggests that a large fraction of marine DOM consists of complex carbohydrates and proteins that are produced directly from biosynthesis, yet are biologically refractory towards microbial degradation. Previous studies have also suggested that a large fraction of CDOM is associated with biological activity. We wish to determine if marine phytoplankton and bacteria produce significant quantities of CDOM, and to compare the chemical characteristics of biologically produced CDOM with CDOM in seawater.

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PART 1

Characterization of Biologically Produced Colored Dissolved Organic Matter

Daniel J. Repeta
Woods Hole Oceanographic Institution
Marine Chemistry and Geochemistry
Woods Hole
MA
02543-1543

Phone (508)-289-2635
FAX (508)-457-2164
drepeta@whoi.edu

Grant# N00014-98-1-0579

ONR Program Officer: Anna Palmisano/ Linda Chrisey

Long term Research Objective: Colored dissolved organic matter (CDOM) is one of the principal light-attenuating components of seawater. Over the past decade considerable progress has been made in describing the optical properties of CDOM. However, our understanding of CDOM structure and chemistry has not advanced apace, and we do not yet understand many of the factors that introduce and remove CDOM in seawater. Our objectives are to chemically characterize CDOM and to develop techniques for studying CDOM cycling in seawater. Recent work suggests that a large fraction of marine DOM consists of complex carbohydrates and proteins that are produced directly from biosynthesis, yet are biologically refractory towards microbial degradation. Previous studies have also suggested that a large fraction of CDOM is associated with biological activity. We wish to determine if marine phytoplankton and bacteria produce significant quantities of CDOM, and to compare the chemical characteristics of biologically produced CDOM with CDOM in seawater.

Science and Technology Objectives: In our current ONR award we are evaluating the production of CDOM by different class of marine phytoplakton in culture (diatoms, dinoflagellates, prymnesiophytes, cyanobacteria,and prochlorophytes). We are also evaluating the efficiency of several ultrafiltration and resin adsorption techniques from removal and ultimate recovery of CDOM from seawater and culture media. Techniques developed in the first stages of our project will be used to remove CDOM from select cultures for chemical characterization.

Approach: Anxenic (bacteria-free) cultures of phytoplankton representative of the major class of marine algae in seawater are grown in CDOM free seawater media. The algae are removed by filtration and the media is processed by ultrafiltration (1kD and 0.5 kD membranes) and/or resins (XAD, octadecyl-silica) to remove CDOM. CDOM collected by resin adsorption is recovered by elution. The optical properties of both the recovered

and non recoverable CDOM are determined (absorption, fluorescence, Ex/Em) and CDOM concentrates are characterized by spectrometric (NMR/IR/MS) and molecular chemical techniques.

Science and Technology Completed: Over the past year we have initiated axenic cultures of *Chaetoceros neogracile, Emiliana huxleyii, Amphidinium carterae*, and Prochlorococcus sp. CDOM is recovered by ultrafiltration and/or XAD/Octadecyl resins. The recoveries, optical and chemical properties of CDOM are currently being measured.

Impact/Navy Relevance: CDOM rapidly attenuates light in seawater and is a major impediment to the use of in-situ optical and remote sensors for environmental monitoring.

Planned Research Efforts: ONR supports a large number of research projects which are effected by the optical properties of CDOM. Progress in seawater optics is limited by our understanding of CDOM chemistry. Our research program is designed to advance our understanding of CDOM chemistry and biology so that more effective approaches can be developed for understanding the optical and photochemical properties of CDOM.

Other sponsored Science and Technology: Please see the following two pages.

CURRENT AND PENDING SUPPORT

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: **Repeta, Daniel J.**

Other agencies to which this proposal has been/will be submitted.

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **WHOI Education Program**

Source of Support: **WHOI Education**

Total Award Amount: $ Total Award Period Covered: **1/1/99 to 12/31/99**

Location of Research: **Woods Hole Oceanographic Institution**

Person-Months Per Year Committed to the Project. Cal: **2.6** Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Speciation and Structural Characterization of Plutonium and Actinide-organic Complexes in Surface and Groundwaters (K. Buesseler, Co-PI)**

Source of Support: **DOE; DE-FG07-96ER14733**

Total Award Amount: $ **650,481** Total Award Period Covered: **9/1/96 to 8/31/99**

Location of Research: **Woods Hole Oceanographic Institution**

Person-Months Per Year Committed to the Project. Cal: **4/3/3** Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Collaborative Studies on Pigments in Seawater and Marine Sediments**

Source of Support: **NSF; INT-9512876**

Total Award Amount: $ **14,880** Total Award Period Covered: **9/1/96 to 8/31/99**

Location of Research: **Woods Hole Oceanographic Institution**

Person-Months Per Year Committed to the Project. Cal: **0** Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Characterization of Biologically Produced Colored Dissolved Organic Matter**

Source of Support: **ONR; N00014-98-1-0579**

Total Award Amount: $ **182,749** Total Award Period Covered: **9/1/98 to 8/31/00**

Location of Research: **Woods Hole Oceanographic Institution**

Person-Months Per Year Committed to the Project. Cal: **2/1.5** Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Chlorophyll dN-15: An Isotopic Benchmark for Understanding N Cycling and Paleochemistry in the Mediterranean Sea**

Source of Support: **NSF; OCE-9711702**

Total Award Amount: $ **396,998** Total Award Period Covered: **9/15/97 to 8/31/00**

Location of Research: **Woods Hole Oceanographic Institution**

Person-Months Per Year Committed to the Project. Cal: **3/3/4** Acad: Sumr:

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*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

CURRENT AND PENDING SUPPORT

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: **Repeta, Daniel J.**

Other agencies to which this proposal has been/will be submitted.

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Dissolved Organic Nitrogen and Brown Tide Blooms in Long Island Coastal Waters**

Source of Support: **NSF; OCE-9730015**

Total Award Amount: $ **365,386** Total Award Period Covered: **4/1/98 to 3/31/01**

Location of Research: **Woods Hole Oceanographic Institution**

Person-Months Per Year Committed to the Project. Cal: **1.5/1.5/1.5** Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Chemical Characterization and Biogeochemical Cycling of UDOM in Seawater**

Source of Support: **NSF: OCE-9818654**

Total Award Amount: $ **380,000** Total Award Period Covered: **3/1/99 to 02/28/02**

Location of Research: **Woods Hole Oceanographic Institution**

Person-Months Per Year Committed to the Project. Cal: **3/3/3** Acad: Sumr:

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Carbon Budgets in the NW Atlantic Ocean Margin: A Synthesis and Modeling Project**

Source of Support: **Skidaway/NSF Subcontract; WHOI Proposal No. 2157.1**

Total Award Amount: $ **25,243** Total Award Period Covered: **6/1/99 to 5/31/01**

Location of Research: **Woods Hole Oceanographic Institution**

Person-Months Per Year Committed to the Project. Cal: **1/0.5** Acad: Sumr:

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Acquisition of a Nuclear Magnetic Resonance Spectrometer for Biogeochemical Research**

Source of Support: **NSF; WHOI Proposal No. CH10301**

Total Award Amount: $ **251,850** Total Award Period Covered: **10/1/99 to 9/30/00**

Location of Research: **Woods Hole Oceanographic Institution**

Person-Months Per Year Committed to the Project. Cal: **0** Acad: Sumr:

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Speciation, Mobility and Fate of Actinides in the Groundwater at the Hanford Site**

Source of Support: **DOE EMSP; WHOI Proposal No. CH10331**

Total Award Amount: $ **1,198,161** Total Award Period Covered: **9/15/99 to 9/14/02**

Location of Research: **Woods Hole Oceanographic Institution**

Person-Months Per Year Committed to the Project. Cal: **1/1/1** Acad: Sumr:

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

PART 2

Characterization of Biologically Produced Colored Dissolved Organic Matter

Daniel J. Repeta
Woods Hole Oceanographic Institution
Marine Chemistry and Geochemistry
Woods Hole
MA
02543-1543

Phone (508)-289-2635
FAX (508)-457-2164
drepeta@whoi.edu

Grant# N00014-98-1-0579

ONR Program Officer: Anna Palmisano/ Linda Chrisey

Subcontractors: 0

Journal publications appearing in print: 0

Formal technical reports released by your institution: 0

Presentations (indicate invited presentations): "Biological production of colored dissolved organic matter" ONR CDOM workshop, Baltimore, MD, April 1999.

Books or book chapters published: 0

Patents (indicate status, e.g., filed, issued): 0

Honors, awards or prizes received during the reporting year: 0

Number of Students Supported (minimum of 1/4 of their support): 0

Post Doctoral: 0 Doctoral:____ Masters:_____ Undergraduate:____

Of these students, the number who were:

Females: 0

Under-represented Ethnic groups: 0